

CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

- 1 1. A modified hybrid for an analog front end, comprising:
2 a fixed portion configured to match an effective impedance of a transmission line
3 as seen at the analog front end and to generate a filtered replica of a local transmit signal;
4 and
5 an adaptive portion containing a plurality of controllable circuit elements arranged
6 to form a biquad and a summer to produce a transfer function configured to compensate
7 for transmission line irregularities, wherein the adaptive portion receives the filtered
8 replica of the local transmit signal and mathematically combines weighted signal
9 components with a duplex signal to recover a remotely generated receive signal in a
10 single operation at a hybrid amplifier.
- 1 2. The hybrid of claim 1, wherein the fixed portion comprises passive circuit
2 elements.
- 1 3. The hybrid of claim 1, wherein the adaptive portion is implemented on an
2 integrated circuit.
- 1 4. The hybrid of claim 1, wherein the biquad and the summer are
2 implemented via a balanced differential circuit configuration.
- 1 5. The hybrid of claim 1, wherein the adaptive portion transfer function is
2 modified to compensate for a bridged tap induced frequency notch.
- 1 6. The hybrid of claim 1, wherein the signal components comprise a band
2 pass output a low pass output.

1 7. The hybrid of claim 2, wherein the passive circuit elements are selected
2 and arranged to match the impedance of the combination of a standard isolation
3 transformer associated with a local loop.

1 8. The hybrid of claim 5, wherein the bridged tap induced frequency notch
2 comprises a range of frequencies where the phase of the local transmit signal exceeds a
3 threshold beyond which the hybrid fails.

1 9. The hybrid of claim 6, wherein the signal components are weighted in the
2 summer by controllable impedances.

1 10. An improved analog front end, comprising:
2 means for receiving a duplex signal transmission;
3 means for matching the effective impedance of a transmission line as seen at the
4 analog front end in the absence of transmission line irregularities; and
5 means for adaptively compensating for at least one bridged tap induced frequency
6 notch in the transfer function identifying the analog front end.

1 11. The analog front end of claim 10, wherein the means for receiving
2 comprises a hybrid.

1 12. The analog front end of claim 10, wherein the means for matching
2 comprises a fixed portion of a hybrid.

1 13. The analog front end of claim 10, wherein the means for adaptively
2 compensating comprises a biquad and a summer.

1 14. The analog front end of claim 12, wherein the fixed portion of the hybrid
2 comprises a passive network of discrete devices.

1 15. The analog front end of claim 13, wherein the biquad and a summer
2 comprise a plurality of controllably selected circuit elements having various fixed
3 impedances.

1 16. The analog front end of claim 15, wherein the plurality of controllably
2 selected circuit elements comprise elements selected from the group consisting of
3 integrated circuit resistors, capacitors, and transconductors.

1 17. A transceiver, comprising:
2 an analog front end having a modified hybrid comprising:
3 a first portion configured to match the effective impedance of a transmission line
4 as seen at the analog front end in the absence of transmission line irregularities and to
5 filter a duplex signal; and
6 a second portion implemented on an integrated circuit, the second portion
7 configured to receive the filtered duplex signal and adaptively compensate for at least one
8 transmission line irregularity observed in the absence of a remote signal transmission.

1 18. The transceiver of claim 17, wherein the second portion is adaptively
2 controlled to compensate for at least one transmission line irregularity reflective of
3 environmental conditions surrounding the transmission line.

1 19. A method for configuring a local transceiver to minimize the transmit
2 power required at a remote transmitter, comprising:
3 applying a locally generated transmit signal to an improved front end in the
4 absence of a remote signal, the front end containing a hybrid having a balance network
5 further comprising a fixed portion and an adaptive portion;
6 optimizing the transmit signal power;
7 recording a reflected version of the optimized transmit signal in a receive path;
8 applying the adaptive portion of the balance network when indicated by at least
9 one characteristic associated with the reflected transmit signal;
10 controllably adjusting the adaptive portion of the balance network to minimize the
11 amplitude of the reflected version of the transmit signal in the receive path; and
12 notifying a remote transceiver to initiate a self-directed transmit signal power
13 optimization scheme.

1 20. The method of claim 20, wherein the step of applying comprises supplying
2 the locally generated transmit signal to a fixed portion of a hybrid configured to match the
3 effective impedance of a transmission line as seen at the improved front end.

1 21. The method of claim 20, wherein controllably adjusting comprises
2 performance of a steepest descent algorithm.

1 22. The method of claim 20, wherein controllably adjusting comprises
2 performance of a recursive least squares (RLS) algorithm.

1 23. The method of claim 20, wherein the step of applying the adaptive portion
2 of the hybrid is responsive to at least one transmission line characteristic reflective of a
3 bridged tap associated with the transmission line.

1 24. A method for recovering a remotely generated signal from a transmission
2 line in a duplex signal communication system, comprising:
3 applying a locally generated transmit signal to an improved front end in the
4 absence of a remote transmit signal, the front end containing a hybrid having a balance
5 network further comprising a fixed portion and an adaptive portion;
6 recording a reflected version of the optimized transmit signal in a receive path;
7 controllably adjusting the adaptive portion of the balance network to minimize the
8 amplitude of the reflected version of the locally generated transmit signal in the receive
9 path; and
10 combining a scaled replica of the locally generated transmit signal with a plurality
11 of adaptive portion outputs and a duplex signal on a transmission line to recover a
12 remotely generated receive signal from the transmission line.

1 25. The method of claim 24, wherein the step of applying comprises supplying
2 the locally generated transmit signal to a fixed portion of a hybrid configured to match the
3 effective impedance of a transmission line as seen at the improved front end.

1 26. The method of claim 24, wherein controllably adjusting comprises
2 performance of an optimization algorithm.

1 27. The method of claim 26, wherein the optimization algorithm is selected
2 from the group consisting of a steepest descent algorithm and a recursive least squares
3 (RLS) algorithm.

1 28. The method of claim 26, wherein the step of combining comprises
2 weighting and mathematically combining signal components with the receive signal in a
3 single operation at a hybrid amplifier.